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Takahashi et al.

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(54) **THERMAL ACTIVATION DEVICE**

(75) Inventors: **Masanori Takahashi**, Chiba (JP); **Minoru Hoshino**, Chiba (JP); **Yoshinori Sato**, Chiba (JP); **Tatsuya Obuchi**, Chiba (JP)

(73) Assignee: **Seiko Instruments Inc.** (JP)

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B41J 2/00 (2006.01)

(52) **U.S. Cl.** **347/191**

(58) **Field of Classification Search** 347/171, 347/191, 223, 187–189, 194–197; 400/120.09, 400/120.11, 279

See application file for complete search history.

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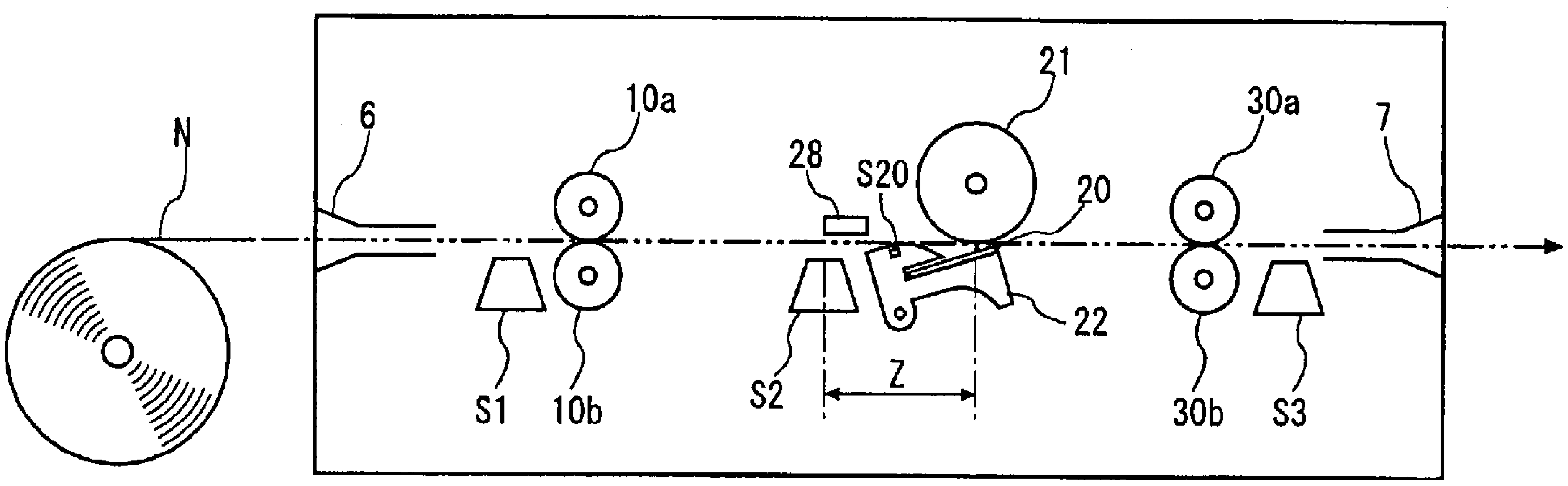
Primary Examiner—K. Feggins
(74) *Attorney, Agent, or Firm*—Adams & Wilks

(57) **ABSTRACT**

A thermal activation device has a thermal head having heat generating elements for generating heat to heat a thermal activation sheet. A radiator absorbs and dissipates heat generated by the heat generating elements of the thermal head. The radiator has a portion disposed in contact with an introduction path along which the thermal activation sheet is introduced toward the thermal head for contacting the thermal activation sheet to preheat the thermal activation sheet as the thermal activation sheet advances in the introduction path.

22 Claims, 5 Drawing Sheets



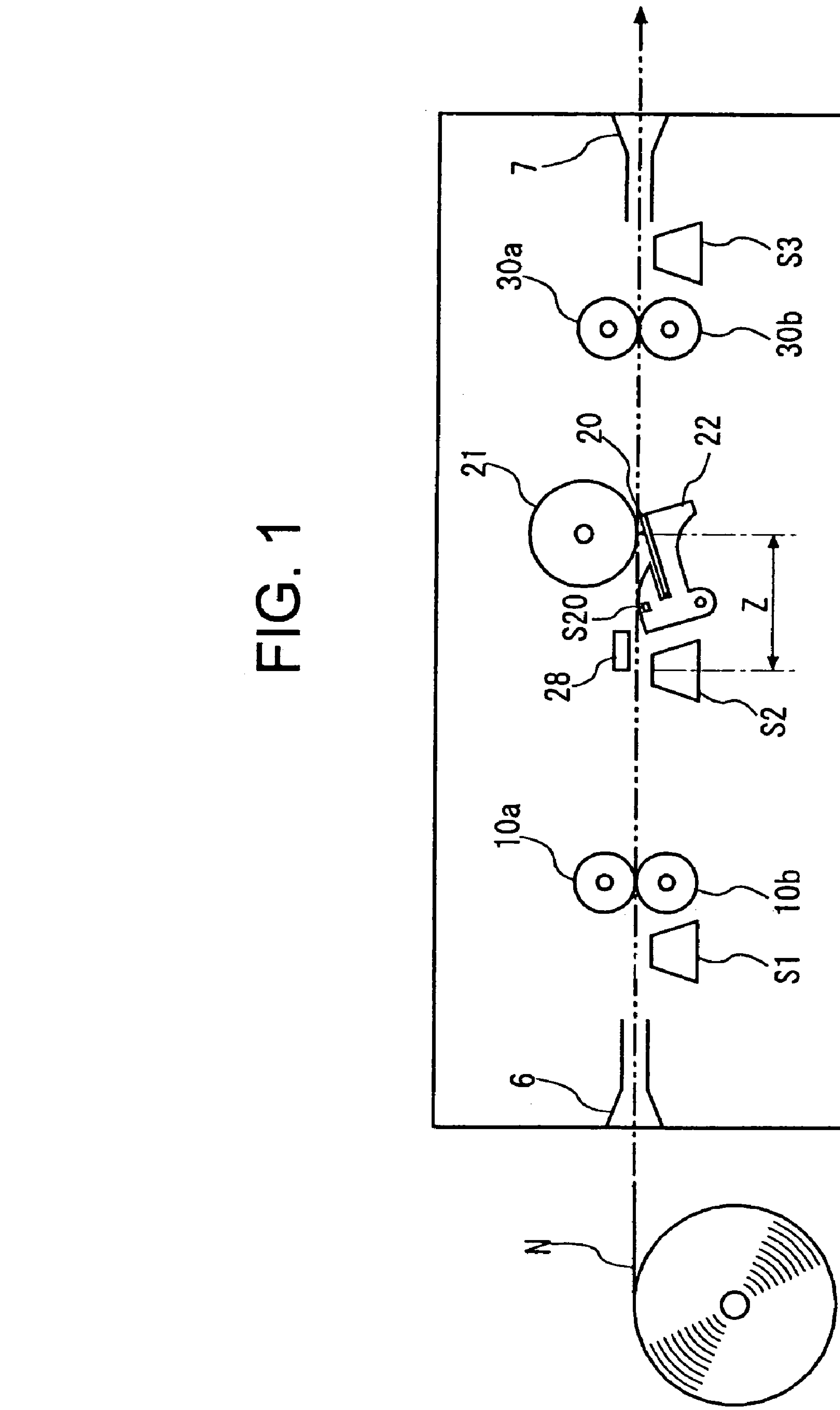


FIG. 1

FIG. 2

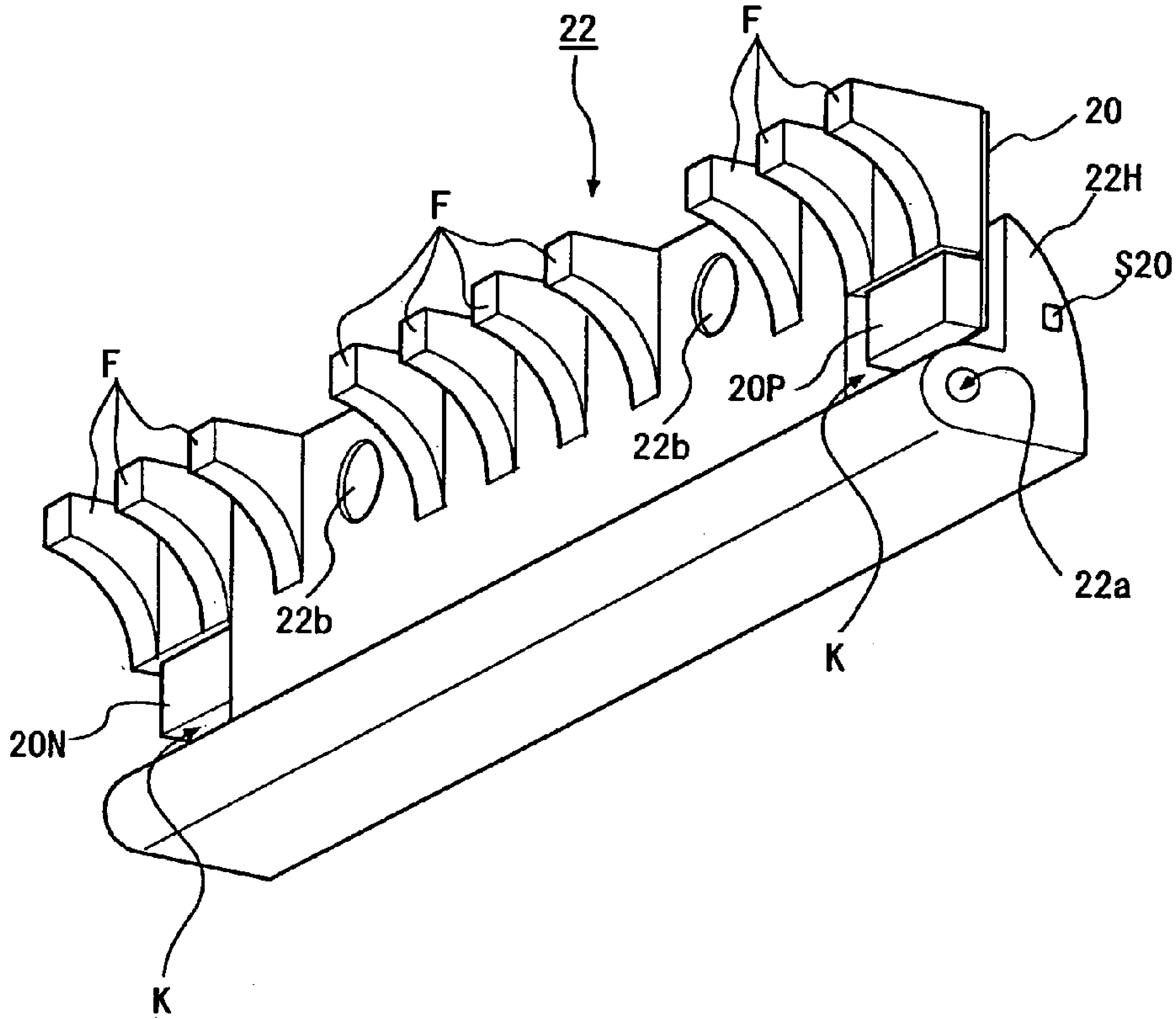


FIG. 3

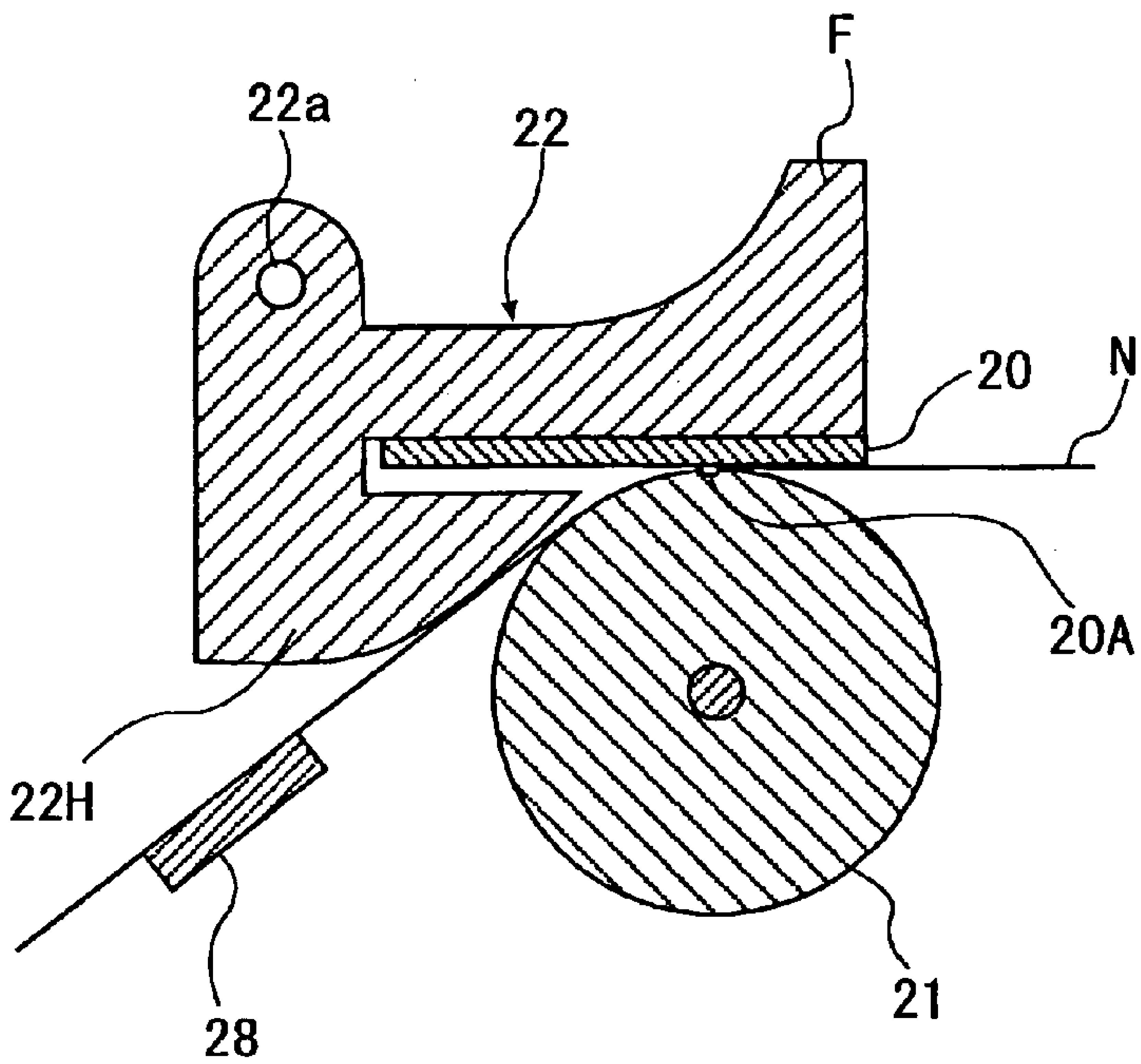


FIG. 4

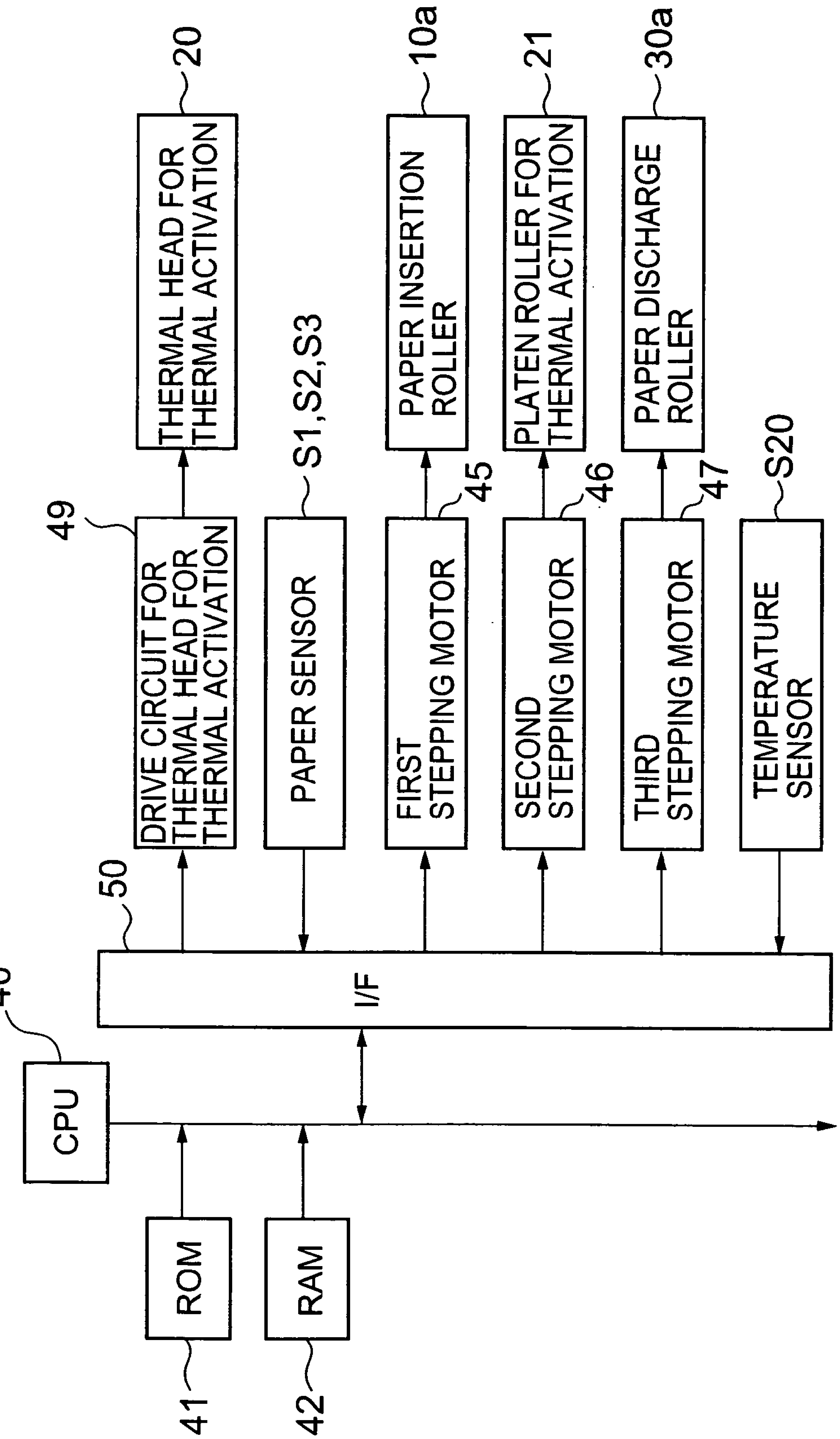

THERMAL HEAD FOR THERMAL ACTIVATION
20
PAPER INSERTION ROLLER
10a
PLATEN ROLLER FOR THERMAL ACTIVATION
21
PAPER DISCHARGE ROLLER
30a
DRIVE CIRCUIT FOR THERMAL HEAD FOR THERMAL ACTIVATION
49
PAPER SENSOR
S1,S2,S3
FIRST STEPPING MOTOR
45
SECOND STEPPING MOTOR
46
THIRD STEPPING MOTOR
47
TEMPERATURE SENSOR
S20
I/F
50
CPU
40
ROM
41
RAM
42

FIG. 5

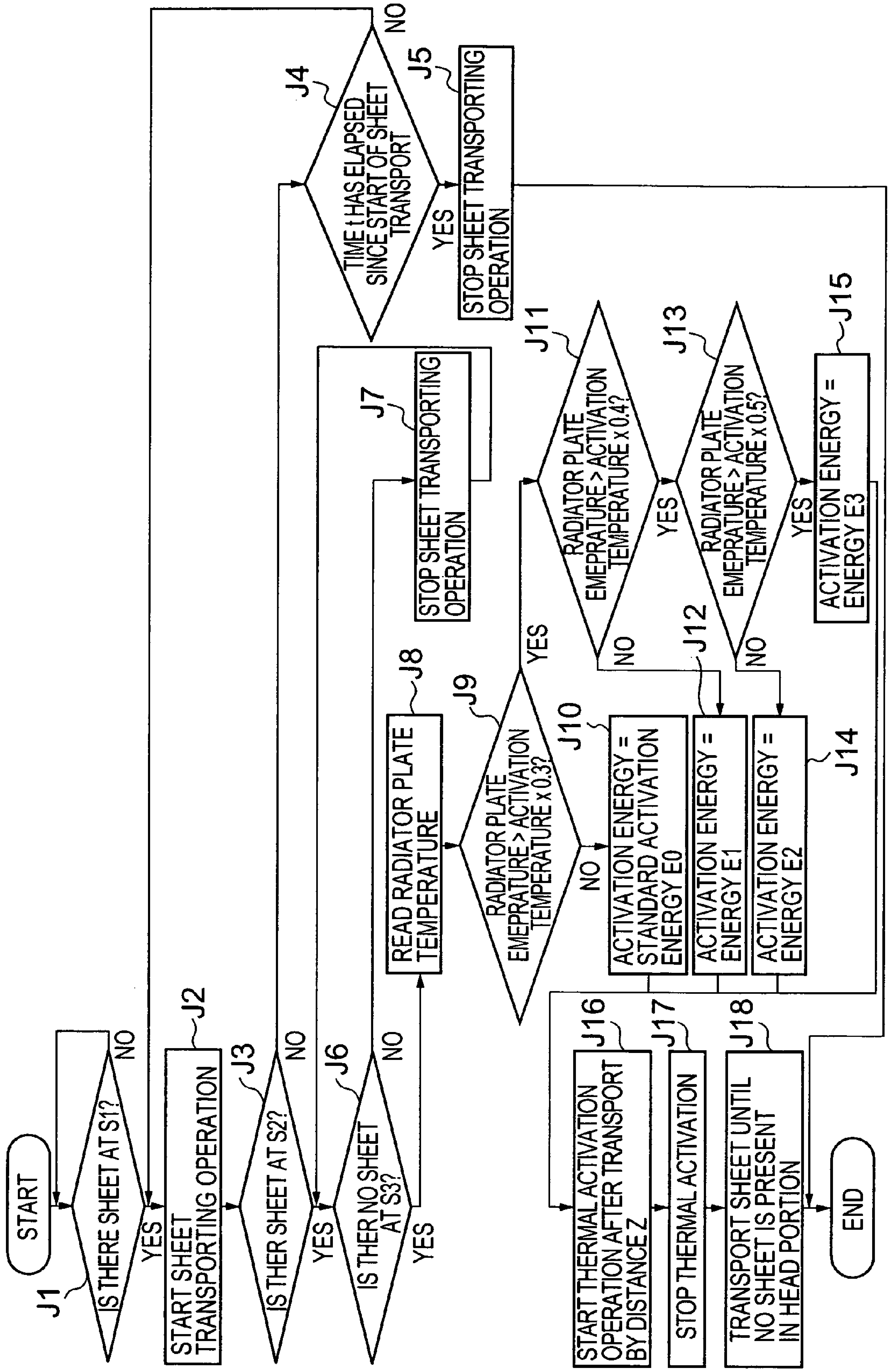
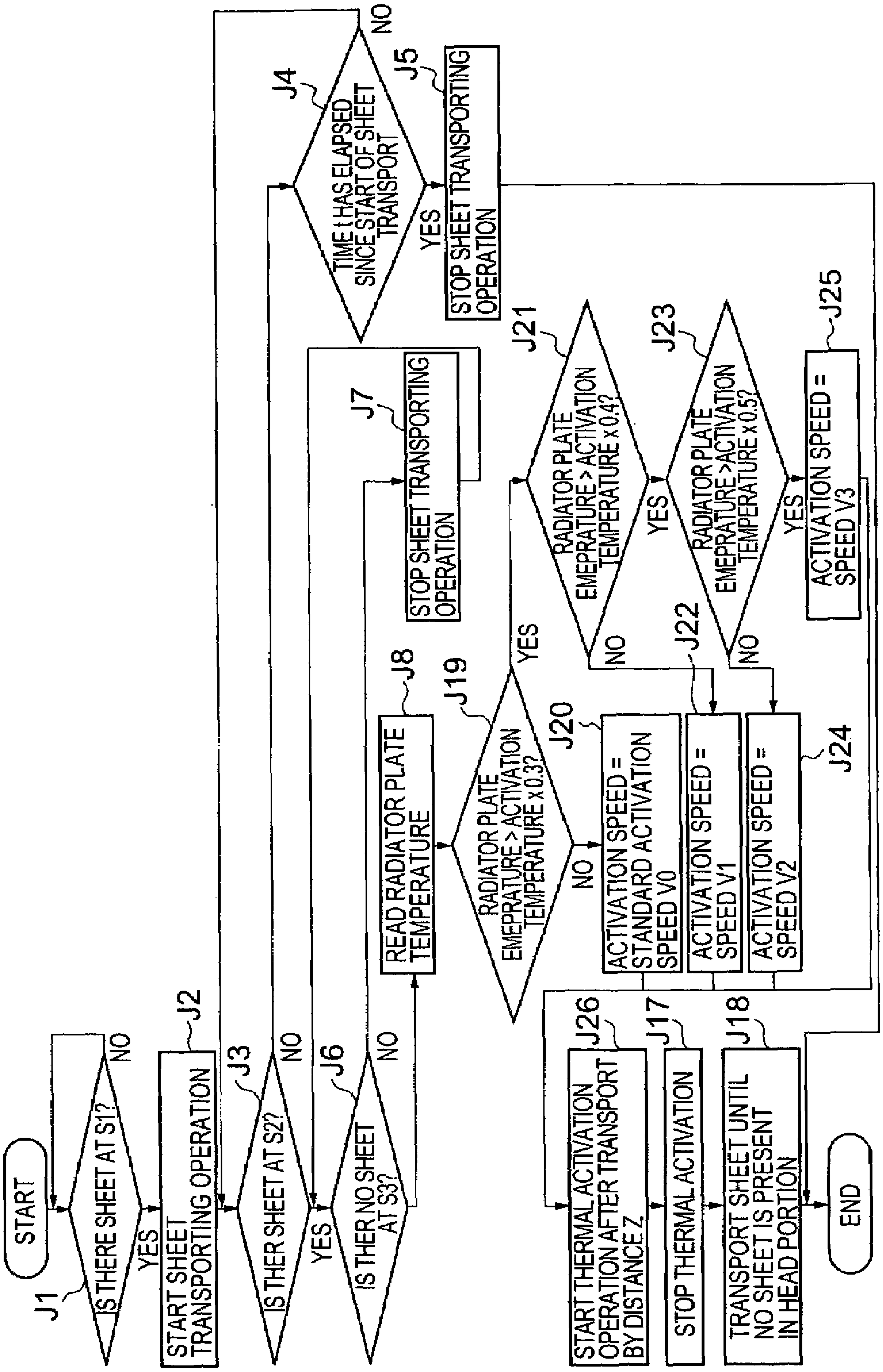

START
J1
IS THERE SHEET AT S1?
YES
NO
J2
START SHEET TRANSPORTING OPERATION
J3
IS THER SHEET AT S2?
YES
NO
J4
TIME t HAS ELAPSED SINCE START OF SHEET TRANSPORT
YES
NO
J5
STOP SHEET TRANSPORTING OPERATION
J6
IS THER NO SHEET AT S3?
YES
NO
J7
STOP SHEET TRANSPORTING OPERATION
J8
READ RADIATOR PLATE TEMPERATURE
J9
RADIATOR PLATE EMEPRATURE > ACTIVATION TEMPERATURE x 0.3?
YES
NO
J10
ACTIVATION ENERGY = STANDARD ACTIVATION ENERGY E0
J11
RADIATOR PLATE EMEPRATURE > ACTIVATION TEMPERATURE x 0.4?
YES
NO
J12
ACTIVATION ENERGY = ENERGY E1
J13
RADIATOR PLATE EMEPRATURE > ACTIVATION TEMPERATURE x 0.5?
YES
NO
J14
ACTIVATION ENERGY = ENERGY E2
J15
ACTIVATION ENERGY = ENERGY E3
J16
START THERMAL ACTIVATION OPERATION AFTER TRANSPORT BY DISTANCE Z
J17
STOP THERMAL ACTIVATION
J18
TRANSPORT SHEET UNTIL NO SHEET IS PRESENT IN HEAD PORTION
END

FIG. 6


START
J1
IS THERE SHEET AT S1?
YES
NO
J2
START SHEET TRANSPORTING OPERATION
J3
IS THER SHEET AT S2?
YES
NO
J4
TIME t HAS ELAPSED SINCE START OF SHEET TRANSPORT
YES
NO
J5
STOP SHEET TRANSPORTING OPERATION
J6
IS THER NO SHEET AT S3?
YES
NO
J7
STOP SHEET TRANSPORTING OPERATION
J8
READ RADIATOR PLATE TEMPERATURE
J19
RADIATOR PLATE EMEPRATURE > ACTIVATION TEMPERATURE x 0.3?
YES
NO
J20
ACTIVATION SPEED = STANDARD ACTIVATION SPEED V0
J21
RADIATOR PLATE EMEPRATURE > ACTIVATION TEMPERATURE x 0.4?
YES
NO
J22
ACTIVATION SPEED = SPEED V1
J23
RADIATOR PLATE EMEPRATURE >ACTIVATION TEMPERATURE x 0.5?
YES
NO
J24
ACTIVATION SPEED = SPEED V2
J25
ACTIVATION SPEED = SPEED V3
J26
START THERMAL ACTIVATION OPERATION AFTER TRANSPORT BY DISTANCE Z
J17
STOP THERMAL ACTIVATION
J18
TRANSPORT SHEET UNTIL NO SHEET IS PRESENT IN HEAD PORTION
END

THERMAL ACTIVATION DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a thermal activation device for heating an adhesive layer of a thermal activation sheet by a thermal head to thereby cause the thermal activation sheet to develop adhesiveness.

2. Description of the Related Art

Thermal activation labels are increasingly used as labels affixed to products manufactured and sold in processed food factories, supermarkets, etc. for indicating such information as product name, price, sellby date, etc. A thermal activation label includes an adhesive layer, which does not normally exhibit adhesiveness, the adhesive layer being activated when applied with a thermal energy, making it possible to affix the adhesive layer to a target object. Sheets having a similar adhesive layer, including the above thermal activation label, are herein referred to under the generic term "thermal activation sheet".

As a conventional thermal activation device for activating such a thermal activation label, a device as disclosed in JP 11-79152 A has been put into practical use. This device includes a thermal head composed of a large number of heat generating elements arranged in one or multiple rows on a substrate. A thermal activation label is passed between the thermal head and a platen roller pressed against the thermal head to heat the thermal activation label, thereby activating an adhesive layer thereof. The use of such a thermal head provides such advantages as allowing a reduction in the overall size of the device as well as enabling a partial activation, whereby only an intended portion of the label can be activated.

In order to effect a clear separation between a thermal-activation portion and a non-thermal-activation portion when performing partial activation or the like in the thermal activation device, the heat generating elements must be able to effect heating and heat dissipation instantaneously. Further, in the case where the entire label surface is to be activated, to reliably activate the label up to its edge portion, it is necessary for the heat generating elements to be able to heat the thermal activation label to a fixed temperature or more instantaneously as the leading edge thereof approaches and reaches the position of the heat generating elements, and to effect heat dissipation instantaneously to lower the temperature of the thermal activation label to below the fixed temperature as the trailing edge thereof passes the position of the heat generating elements and the platen roller and thermal head come into direct contact with each other.

For this reason, conventional thermal activation devices employing a thermal head uses heat generating elements capable of outputting a large heat quantity to realize instantaneous heating. In addition, to realize instantaneous heat dissipation, a large radiator plate made of a material exhibiting high heat conductivity, such as aluminum, must be provided on the back surface of the thermal head. Therefore, the requisite power consumption and volume of the conventional thermal activation devices are large.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a thermal activation device which enables reduced power consumption and reduced device volume while effecting a clear separation between an activation portion and a non-activation portion of a thermal activation label.

To attain the above object, according to the present invention, there is provided a thermal activation device for heating a thermal activation sheet by using a thermal head having heat generating elements formed therein, the thermal activation device including a radiator adapted to absorb and dissipate a heat of the thermal head and having a portion of the radiator arranged in contact with an introduction path along which the thermal activation sheet is introduced toward the thermal head, the portion of the radiator being brought into contact with the thermal activation sheet to effect preheating as the thermal activation sheet advances in the introduction path.

With the above arrangement, the thermal activation sheet is preheated before it is transported into the location of the heat generating elements of the thermal head, whereby the thermal activation sheet can be activated with a small heat quantity as compared with the case where no preheating is performed. Further, heat is transferred from the radiator to the thermal activation sheet, whereby the same amount of heat dissipation can be attained with less volume as compared with the case where heat is dissipated through radiation or heat is simply dissipated to the atmosphere. Therefore, it is possible to achieve a reduction in power consumption and a decrease in the overall volume of the device.

It is desirable to provide temperature detecting means for detecting the temperature of the radiator.

The temperature of the radiator is not constant but varies depending on how the heat generating members are driven or how the activation sheet flows, and hence detecting the temperature thereof enables various measures to be implemented.

Specifically, the thermal activation device may be provided with control means for controlling an amount of heat applied from the thermal head to the thermal activation sheet, the control means changing the amount of heat applied to the thermal activation sheet based on a detection result from the temperature detecting means.

By adopting such means, the activation sheet can be activated at an appropriate temperature at all times, and wasteful heat generation by the thermal head can be suppressed, making it possible to achieve a further reduction in power consumption.

Here, the control means for controlling the heat quantity can be implemented by controlling the amount of energization of the heat generating elements, by controlling the number of heat generating elements to be energized, or, alternatively, by providing drive means for performing drive to transport the thermal activation sheet at a controlled variable speed, the control means controlling the drive means to vary a transport speed for the thermal activation sheet.

Further, it is desirable that a portion of the radiator which comes into contact with the thermal activation sheet be provided with a member having a lower heat conductivity than that of the other portion of the radiator. With this arrangement, even when the temperature of the radiator changes abruptly, only moderate temperature changes take place in the portion coming into contact with the thermal activation sheet, making it possible to reduce unevenness in the preheating of the thermal activation sheet.

According to the thermal activation device of the present invention, the heat transferred from the heat generating elements to the radiator is reused for preheating the thermal activation sheet, whereby activation of the thermal activation sheet can be effected with a small heat generation amount and, because the heat is allowed to escape from the radiator to the thermal activation sheet, the efficiency with which the radiator dissipates heat can be enhanced as well.

Therefore, it is possible to achieve both a reduction in power consumption and miniaturization of the radiator.

Furthermore, in addition to dissipating heat to the ambient air or through radiation, the radiator dissipates heat to the thermal activation sheet, whereby it is possible to suppress a temperature rise inside the casing of the device.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. **1** is a diagram showing the overall construction of a thermal activation device according to an embodiment of the present invention;

FIG. **2** is a perspective view showing a thermal head and a radiator plate which are shown in FIG. **1**;

FIG. **3** is a longitudinal sectional view showing the thermal head and the radiator plate;

FIG. **4** is a block diagram showing the configuration of a control system of the thermal activation device according to the embodiment of the present invention;

FIG. **5** shows a first example of a flow chart illustrating a flow of control processing executed by a CPU shown in FIG. **4**; and

FIG. **6** shows a second example of the flow chart illustrating a flow of control processing executed by a CPU shown in FIG. **4**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinbelow, embodiments of the present invention are described with reference to the drawings.

FIG. **1** shows the general construction of a thermal activation device according to an embodiment of the present invention.

The thermal activation device according to this embodiment comprises paper insertion rollers **10***a* and **10***b* for introducing a thermal activation sheet N, which is cut into a predetermined length, through an introduction port **6** feeding it to the interior portion of the device; a paper insertion detecting sensor S**1** which detects the presence/absence of the thermal activation sheet N that has been inserted from the introduction port **6**; a thermal head **20** having a large number of heat generating elements formed on a substrate in one or multiple rows; a platen roller **21** for effecting paper feeding while pressing the thermal activation sheet N against the portion of the thermal head **20** where the heat generating elements are formed; a radiator plate **22** supporting the thermal head **20** while cooling the thermal head **20**; a sensor S**2** for detecting paper in the thermal head portion (hereinafter referred to as the "thermal head portion paper detecting sensor) which detects the presence/absence of the thermal activation sheet N that has been transported into the location of the thermal head **20**; paper discharge rollers **30***a* and **30***b* for sending the thermal activation sheet N toward a discharge port **7**; and a paper discharge detecting sensor **31** which detects the presence/absence of the thermal activation sheet N at a position forward of the discharge port **7**.

Further, arranged upstream from the above thermal activation device are a roller paper accommodating portion for accommodating roll paper consisting of a thermal activation sheet wound into a roll, a printing device (not shown) which performs printing on a print surface on the backside of an adhesive layer surface of the thermal activation sheet, and a cutting device (not shown) for cutting the thermal activation sheet as it is continuously fed into a predetermined length and supplies the cut sheet to the thermal activation device. The thermal activation sheet N, which has been thus cut into the predetermined length and supplied by those components, is sent from the introduction port **6** to the paper insertion rollers ba and lob, the thermal head **20**, and then to the paper discharge rollers **30***a* and **30***b* sequentially before being discharged from the discharge port **7**.

It is to be noted that while the transport path for the thermal activation sheet N is substantially linear in FIG. **1**, the transport path may be formed as a curved path by providing, at some midpoint in the path, a guide or the like for guiding the thermal activation sheet N.

FIG. **2** is a perspective view showing the thermal head **20** and the radiator plate **22** in detail, and FIG. **3** is a longitudinal sectional view thereof.

The radiator plate **22** is made of a member having a high heat conductivity, such as aluminum, which is bonded onto the back surface of the thermal head **20** to let the heat of the thermal head **20** escape into the ambient air or dissipate through radiation. Formed on the back surface side of the radiator plate **22** are fins F provided for enhancing the heat dissipation efficiency. Further, notches K are formed at positions of the radiator plate **22** corresponding to the right and left sections on the back surface of the thermal head **20**. Connection terminals **20**P and **20**N for energizing the thermal head **20** are exposed at the location of those notches.

The radiator plate **22** also functions as a frame for axially supporting the thermal head **20** such that the thermal head **20** can freely rotate. The radiator plate **22** is axially supported to the frame of the device through a shaft hole **22***a*. Further, the thermal head **20** is pressed against the platen roller **21** as one end of a spring is brought into abutment against recessed portions **22***b* formed on the back surface side. The platen roller **21** is so placed as to be pressed against a heat generating element forming portion **20**A of the thermal head **20** (FIG. **3**).

Further, formed in the radiator plate **22** is an overhanging portion **22**H overhanging to the front side of the thermal head **20**, with the overhanging portion **22**H coming into contact with the thermal activation sheet N in the sheet transport path between a guide **28** and the platen roller **21**. The portion of the overhanging portion **22**H which comes into contact with the sheet is formed as a curved surface with a modest curvature, contacting the thermal activation sheet N over a fixed area. A temperature sensor S**20** such as a thermistor is mounted on either side surface of the overhanging portion **22**H.

FIG. **4** is a block diagram showing a control system of the thermal activation device of this embodiment.

In the thermal activation device of this embodiment, the control system comprises a Cpu (Central Processing Unit) **40** which controls the device as a whole; a ROM (Read Only Memory) **41** storing a control program and control data executed by the CPU **40**; a RAM (Random Access Memory) **42** which provides a working area for the CPU **40**; first to third drive motors **45** to **47** such as stepping motors for driving the paper insertion roller **10***a*, the platen roller **21**, and the paper discharge roller **30***a* such that their respective drive amounts can be controlled; a thermal head driving circuit **49** for supplying a drive current to the heat generating elements of the thermal head **30**; and an interface **50** for making input/output of signals between the CPU **40** and respective drive portions or sensors.

The interface **50** is connected with the detecting sensors **S1** to S3 for detecting the presence/absence of the thermal activation sheet N, the temperature sensor S**20** for the radiator plate **22**, which are described above, and the like.

Hereinbelow, description is made on operations for controlling the thermal activation device configured as described above.

FIG. **5** shows a first example of a flowchart explaining the control program for the thermal activation device executed by the CPU **40**.

The control program effects a control such that the thermal activation sheet N is transported at appropriate timings within the device, and that when thermally activating the thermal activation sheet N with the thermal head, the thermal activation energy of the thermal head **20** is varied according to the temperature of the radiator plate **22**.

Once the processing of the flowchart commences upon input of an operation ON signal to the thermal activation device, first, in step J**1**, it is determined whether or not the thermal activation sheet N has been supplied to the location of the paper insertion rollers **10***a* and **10***b* by checking a signal from the detecting sensor S**1** present in the paper introduction portion. If the result of the determination indicates that the thermal activation sheet N has not been supplied, the processing of step J**1** is repeated; once a positive determination has been made, the process then transfers to step J**2**.

In step J**2**, the drive motors **45** to **47** are driven to start the transporting of the thermal activation sheet N, and then the process transfers to step J**3**.

In step J**3**, the signal of the detecting sensor S**2** in the intermediate section of the device is checked to determine whether or not the thermal activation sheet N to be transported to the location of the thermal head **20** has been detected. If the determination is positive, the process transfers to J**6**. Meanwhile, if the determination is negative, the process transfers to step J**4** to determine whether or not a predetermined period of time t (for example, 0.5 to 1 second) has elapsed since the start of the sheet transport. If the determination is negative, the process returns to step J**2** again to continue the transporting of the sheet; if it is determined that the predetermined period of time t has elapsed, an error is judged to have occurred, so that the transporting of the sheet is stopped and the processing of the flowchart ends.

When the detecting sensor S**2** in the intermediate section detects the thermal activation sheet N, the process transfers to step J**6** where the signal of the detecting sensor S**3**, located in the paper discharge position, is checked to determine whether or not the thermal activation sheet N, which has been discharged to the position of the discharge port **7** in the previous processing, has been drawn out. If the determination is positive, the process transfers to thermal activation processing of step J**8** onward, but if the thermal activation sheet N remains at the discharge port **7** without being drawn out therefrom, the drive motors **45** to **47** are stopped in step J**7** and the process returns to step J**6** again.

Once the thermal activation processing becomes ready with no previously processed thermal activation sheet remaining at the discharge port **7**, the process transfers to step J**8** where the detection signal of the temperature sensor S**20** is read, and then the process transfers to step J**9**. Thereafter, through the processing of steps J**9** to J**15**, the thermal activation energy is set as shown in items A to D below in accordance with the thus read temperature.

A: The temperature of the radiator plate **22** is lower than 0.3 times the activation temperature for the thermal activation sheet N→A standard activation energy E**0** is set as the thermal activation energy.

B: The temperature of the radiator plate **22** is within the range of 0.3 to 0.4 times the activation temperature→An energy E**1** is set as the thermal activation temperature.

C: The temperature of the radiator plate **22** is within the range of 0.4 to 0.5 times the activation temperature→An energy E**2** is set as the thermal activation temperature.

D: The temperature of the radiator plate **22** is equal to or higher than 0.5 times the activation temperature→An energy E**3** is set as the thermal activation temperature.

Herein, the standard activation energy E**0** refers to a magnitude of energy suitable for activating the thermal activation sheet N with the radiator plate **22** being at room temperature. Further, the energies E**1** to E**3** are values within the range of, for example, 0.5 to 0.95 times the standard activation energy E**0**, and satisfy a relationship of energy E**1**>energy E**2**>energy E**3**.

That is, when the temperature of the radiator plate **22** is high and, as a result, the temperature of the thermal activation sheet N becomes high, the thermal activation energy of the thermal head **20** is set low, whereas when, conversely, the temperature of the radiator plate **22** is low and the preheating temperature of the thermal activation sheet N thus becomes low, the thermal activation energy of the thermal head **20** is set high. The respective values of the energies E**1** to E**3** vary according to such factors as the contact surface area, the contact strength, and also the kind of the thermal activation sheet N, and are dictated by how much the thermal activation sheet N is elevated in temperature through preheating with the radiator plate **22**.

Further, the actual setting of the thermal activation energy is made by setting the amount of energization of the heat generating elements or the number of heat generating elements to be energized.

Once the setting of the thermal activation energy is completed through the processing of steps J**9** to J**15**, in the subsequent step J**16**, the thermal activation sheet N is advanced by a distance Z, and just as the leading edge thereof is about to reach the location of the heat generating element forming portion **20**A of the thermal head **20**, the thermal head **20** is driven, thereby starting the thermal activation operation. During the thermal activation operation, the drive of the heat generating elements is performed by the energization method set in steps J**9** to J**15** mentioned above.

Subsequently, the following processing steps are carried out in sequential order, namely, stopping the thermal activation operation (energization of the heat generating elements) upon completing the thermal activation operation of a predetermined length of time (step J**17**), and stopping the transporting operation once the thermal activation sheet N has been transported to a position where the trailing edge of the thermal activation sheet N passes through between the thermal head **20** and the platen roller **21** (step J**18**), thus completing thermal activation processing for one sheet.

With the control program configured as described above, the thermal activation energy of the thermal head **20** is adjusted for each of the case where the frequency of the thermal activation processing is low and the temperature of the radiator plate **22** is low and the case where the frequency of the thermal activation processing is high and the temperature of the radiator plate **22** is high, thus effecting the activation of the thermal activation sheet N with the minimum required energy.

FIG. **6** shows a second example of a flowchart explaining the control program of the thermal activation device executed by the CPU **40**.

The control program according to the second example is different from the control program shown in FIG. **5** only in the operations and settings for the thermal activation processing; otherwise, this control program executes the same processing as that of FIG. **5**. Therefore, description of the same or identical processing is omitted, and the following description focuses only on the setting processing of steps J**19** to J**25** and the thermal activation processing of step J**26**.

Referring to the flowchart, the temperature of the radiator plate **22** is read in step J**8** and the process transfers to step J**19** where, through the processing of steps J**19** to J**25**, the transport speed (hereinafter referred to as the "activation speed") for the thermal activation sheet N is set as shown in items A to D below in accordance with the thus read temperature.

A: The temperature of the radiator plate **22** is lower than 0.3 times the activation temperature for the thermal activation sheet N→A standard activation speed V**0** is set as the activation speed.

B: The temperature of the radiator plate **22** is within the range of 0.3 to 0.4 times the activation temperature→A speed V**1** is set as the activation speed.

C: The temperature of the radiator plate **22** is within the range of 0.4 to 0.5 times the activation temperature→A speed V**2** is set as the activation speed.

D: The temperature of the radiator plate **22** is equal to or higher than 0.5 times the activation temperature→A speed V**3** is as the activation speed.

Herein, the standard activation speed V**0** refers to a transport speed suitable for activating the thermal activation sheet N with the radiator plate **22** being at room temperature. Further, the speeds V**1** to V**3** are values within the range of, for example, 1. 05 to 1.8 times the standard activation speed V**0**, and satisfy a relationship of speed V**1**>speed V**2**>speed V**3**. The respective values of the speeds V**1** to V**3** vary according to such factors as the surface area or speed of contact between the radiator plate **22** and the thermal activation sheet N, and also the kind of the thermal activation sheet N, and are dictated by how much the thermal activation sheet N is elevated in temperature through preheating with the radiator plate **22**.

Then, once the setting of the thermal activation energy is completed through the processing of steps J**19** to J**25**, then, in step J**26**, the thermal activation sheet N is advanced by a distance Z, and just as the leading edge thereof is about to reach the location of the heat generating elements of the thermal head **20**, the platen roller **21** is rotated such that the thermal activation sheet N advances at the set activation speed and, at the same time, the thermal head **20** is driven, thus executing the thermal activation processing.

By varying the transport speed for the thermal activation sheet N in this way, it is possible, while keeping the amount of heat generation by the thermal head **20** constant, to vary the quantity of heat applied per unit area from the thermal head **20** to the thermal activation sheet N.

As described above, according to the thermal activation device of this embodiment, the preheating of the thermal activation sheet N is effected by reusing the heat of the radiator plate **22**, with a result that the thermal activation sheet N can be activated with a small heat quantity as compared with the case where no preheating is performed, making it possible to reduce power consumption.

Further, the heat is transferred from the radiator plate **22** to the thermal activation sheet N, whereby the equivalent heat dissipation effect can be attained with a small volume as compared with the case where heat is dissipated through radiation or heat is simply dissipated to the air. Therefore, it is possible to achieve miniaturization of the device. Further, a temperature rise inside the casing of the device can be suppressed.

Further, the temperature of the radiator is detected and the quantity of heat applied from the thermal head **20** to the thermal activation sheet N per unit area is adjusted based on the thus detected temperature, whereby the thermal activation sheet N can be activated with the minimum required power consumption, and at an appropriate temperature at all times.

It is to be noted that the thermal activation device of the present invention is not limited to the above embodiment and can be subject to various modifications. For example, while in the above embodiment the radiator plate **22** also serves as a support frame for supporting the thermal head **20**, it is also possible to form a support frame and the radiator plate **22** as separate components.

Further, while in the above embodiment the radiator plate **22**, including the portion thereof that comes into contact with the thermal activation sheet N, is formed of one metal, the portion that comes into contact with the thermal activation sheet N may be formed by using a material having a lower heat conductivity (e.g. alloy having a low heat conductivity) than that of the other portion thereof. As a result, even in the case where, for instance, the temperature of the radiator plate **22** changes abruptly as the thermal head **20** is turned on and off, temperature changes can be suppressed in the portion of the radiator plate **22** which comes into contact with the thermal activation sheet N, whereby unevenness in preheating does not develop in the thermal activation sheet. Further, use of a member having a low heat conductivity, such as one formed of polyimide, can prevent overheating of the thermal activation sheet N during preheating, and interposing a member that facilitates sliding, such as one formed of fluorine resin, can prevent jam of the thermal activation sheet N during preheating.

To form the portion that comes into contact with the thermal activation sheet N by using a member different from that of the other portion as described above, for example, a specific member may be formed into a sheet and affixed onto the portion of the radiator plate **22** which comes into contact with the thermal activation sheet N.

While in the above embodiment the temperature sensor that directly measures the temperature of the overhanging portion **22**H of the radiator plate **22** is exemplified as temperature detecting means for detecting the temperature of the radiator, in the case where, for instance, there is a correlation between the temperature at a spaced location from the radiator and the temperature of the radiator, the temperature of the radiator may be detected indirectly based on the temperature at the spaced location.

Other than the above, the specific details etc. set forth in the above embodiment, such as the shape, size, and presence/absence of the radiator fins of the radiator plate **22**, and the shape of the overhanging portion **22**H of the radiator plate **22**, may be changed as appropriate.

Further, while the thermally activation device exemplified in the above embodiment is one which activates the adhesive layer by heating the thermal activation sheet N cut into a predetermined length, it is also possible to construct one thermal activation device by combining a printing mechanism which effects printing processing on the surface of the thermal activation sheet N and a cutting mechanism which cuts the thermal activation sheet N wound in a roll-like shape into a predetermined length.

What is claimed is:

1. A thermal activation device comprising:

a thermal head having a plurality of heat generating elements for generating heat to heat an adhesive layer surface of a thermal activation sheet; and

a radiator for absorbing and dissipating heat generated by the heat generating elements of the thermal head, the radiator having a portion disposed in contact with an introduction path along which the thermal activation sheet is introduced toward the thermal head for contacting the adhesive layer surface of the thermal activation sheet to preheat the thermal activation sheet as the thermal activation sheet advances in the introduction path.

2. A thermal activation device according to claim **1**; further comprising temperature detecting means for detecting a temperature of the radiator.

3. A thermal activation device according to claim **2**; further comprising control means for controlling an amount of heat applied from the heat generating elements of the thermal head to the thermal activation sheet; and wherein the control means includes means for varying the amount of heat to be applied to the thermal activation sheet in accordance with a detection result from the temperature detecting means.

4. A thermal activation device according to claim **3**; further comprising drive means for performing a driving operation to transport the thermal activation sheet at a controlled variable speed; and wherein the control means includes means for controlling the drive means to vary a transport speed for the thermal activation sheet to control an amount of heat applied from the heat generating elements of the thermal head to the thermal activation sheet.

5. A thermal activation device according to claim **4**; wherein the portion of the radiator which comes into contact with the adhesive layer surface of the thermal activation sheet is has a lower heat conductivity than that of other portions of the radiator.

6. A thermal activation device according to claim **3**; wherein the portion of the radiator which comes into contact with the adhesive layer surface of the thermal activation sheet has a lower heat conductivity than that of other portions of the radiator.

7. A thermal activation device according to claim **2**; wherein the portion of the radiator which comes into contact with the adhesive layer surface of the thermal activation sheet has a lower heat conductivity than that of other portions of the radiator.

8. A thermal activation device according to claim **1**; wherein the radiator is integrally connected to the thermal head.

9. A thermal activation device according to claim **8**; further comprising a frame; and wherein the radiator is pivotally mounted on the frame so that the radiator and the thermal head undergo pivotal movement relative to the frame.

10. A thermal activation device according to claim **1**; wherein the portion of the radiator has a surface for surface-to-surface contact with the thermal activation sheet to preheat the thermal activation sheet as the thermal activation sheet advances in the introduction path.

11. A thermal activation device according to claim **1**; further comprising a platen roller for advancing the thermal activation sheet towards the thermal head while pressing the thermal activation sheet against the thermal head.

12. A thermal activation device according to claim **11**; wherein the portion of the radiator is disposed opposite to and confronts the platen roller.

13. A thermal activation device comprising: a thermal head having a plurality of heat generating elements for generating heat to heat a thermal activation sheet; and a radiator for absorbing and dissipating heat generated by the heat generating elements of the thermal head, the radiator having a portion disposed in contact with an introduction path along which the thermal activation sheet is introduced toward the thermal head for contacting the thermal activation sheet to preheat the thermal activation sheet as the thermal activation sheet advances in the introduction path; wherein the portion of the radiator which comes into contact with the thermal activation sheet has a lower heat conductivity than that of other portions of the radiator.

14. A thermal activation device comprising: a thermal head for generating thermal activation energy to thermally activate an adhesive layer surface of a thermal activation sheet; a radiator for absorbing and dissipating heat from the thermal activation energy generated by the thermal head, the radiator having a portion for contacting the adhesive layer surface of the thermal activation sheet to preheat and thermally activate the thermal activation sheet; temperature detecting means for detecting a temperature of the radiator; and control means for controlling the thermal activation energy generated by the thermal head in accordance with the temperature of the radiator detected by the temperature detecting means.

15. A thermal activation device according to claim **14**; wherein the radiator is integrally connected to the thermal head.

16. A thermal activation device according to claim **15**; further comprising a frame; and wherein the radiator is pivotally mounted on the frame so that the radiator and the thermal head undergo pivotal movement relative to the frame.

17. A thermal activation device according to claim **14**; wherein the portion of the radiator has a surface for surface-to-surface contact with the adhesive layer surface of the thermal activation sheet to preheat the thermal activation sheet.

18. A thermal activation device according to claim **14**; wherein the control means controls the thermal activation energy generated by the thermal head by lowering the thermal activation energy when the temperature of the radiator detected by the temperature detecting means is a preselected high temperature and by increasing the thermal activation energy when the temperature of the radiator detected by the temperature detecting means is a preselected low temperature.

19. A thermal activation device according to claim **14**; wherein the portion of the radiator has a curved surface for contacting the thermal activation sheet.

20. A thermal activation device according to claim **14**; further comprising a platen roller for advancing the thermal activation sheet towards the thermal head while pressing the thermal activation sheet against the thermal head.

21. A thermal activation device according to claim **20**; wherein the portion of the radiator is disposed opposite to and confronts the platen roller.

22. A thermal activation device comprising: a thermal head for generating thermal activation energy to thermally activate a thermal activation sheet; a radiator for absorbing and dissipating heat from the thermal activation energy generated by the thermal head, the radiator having a portion for contacting the thermal activation sheet to preheat and

thermally activate the thermal activation sheet; temperature detecting means for detecting a temperature of the radiator; and control means for controlling the thermal activation energy generated by the thermal head in accordance with the temperature of the radiator detected by the temperature detecting means; wherein the portion of the radiator which comes into contact with the thermal activation sheet has a lower heat conductivity than that of other portions of the radiator.

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